

Restoring Interoperability to the Lower 700 MHz Band

July 16, 2013



Restoring Interoperability is Long Overdue

- **December 2007 (prior to auction)** Only Band Class 12 was under consideration by 3GPP
- **March 2008** Auction closes with \$19 Billion in revenue
- **May 2008** Motorola submits paper to 3GPP proposing Band Class 17 – only covers B and C Blocks
- **June 2008** Ericsson questions reason for fracturing the band into separate band classes; Ericsson removes objections after AT&T supports Band Class 17
- **September 2008** 3GPP ratifies Band Class 17 and Band Class 13 (Verizon's Upper C Block)
- **September 2009** A Block licensees petition FCC for device interoperability
- **December 2010** 3GPP ratifies Band Class 12 with 1 MHz guard band
- **November 2011** Ericsson requests that an additional 1 MHz of guard band be provided by Band Class 12 to protect spectrum being acquired from Qualcomm; AT&T speaks at 3GPP in favor of request
- **December 2011** FCC grants approval to AT&T acquisition of Qualcomm D and E Block licensees without conditions addressing interoperability
- **March 2012** FCC adopts Interoperability NPRM
- **June-July 2012** Major lab and field test reports demonstrate no interference risk to Lower B and C Block operations with interoperable devices
- **January 2013** CCA cost-benefit analysis reveals that the costs of restoring interoperability are small and largely avoidable, while the benefits are large, widely-shared, and especially meaningful to consumers



Benefits Far Outweigh Costs

- Restoring interoperability will yield numerous benefits, including:
 - Consumer Benefits: Increased broadband availability and affordability
 - Deployment Benefits: Enhanced spectrum use and greater spectrum efficiency
 - Public Interest Benefits: More innovation, investment, and jobs
 - Competition Benefits: Additional scale economies and roaming opportunities
- Restoring interoperability has few, if any, costs:
 - Exhaustive battery of field and lab tests show no Band Class 12 interference
 - No technical impediments to restoring Lower 700 MHz interoperability exist
 - Interoperability does not materially affect the cost of user equipment, base stations, or network infrastructure
- No alternative to FCC action exists:
 - Industry-based solutions have not emerged and major disincentives exist
 - Moving Channel 51 broadcasters will not resolve interoperability concerns
- Every day of continued inaction frustrates broadband deployment, harms consumers, and thwarts competition:
 - The FCC should immediately adopt an interoperability solution and has sufficient legal authority to do so.



FCC's Legal Authority to Act

The Commission has a long history of ensuring interoperability across wireless networks.

- 1980s – required analog AMPS compatibility standard for cellular systems under Title III “to enable subscribers of one cellular system to use their existing terminal equipment (i.e., mobile handset) in a cellular market in a different part of the country (roaming).”
- 700 MHz C Block – Commission relied on Title III to impose open access requirements, including device-attachment rules, to pursue “balanced spectrum policy,” recognizing that “it may be necessary to vary the regulation of spectrum use to achieve certain critical public interest objectives.”
- Roaming – roaming was mandated under Title III to encourage “the development of a seamless, nationwide ‘network of networks.’”
- As Senator Warner noted at a recent Senate Commerce Committee hearing on the State of Wireless, “we would not have a wireless system in America but for the requirement the FCC made 35 years ago on interoperability.” Sen. Mark Warner (June 4, 2013).



FCC's Legal Authority to Act

- The interoperability rule can be properly framed, pursuant to Section 303(b), as a regulation of the “nature of service to be rendered” by 700 MHz A Block licensees.
 - The rule would not impose requirements on device manufacturers, but rather would tell carriers what they have to do as a condition of holding a 700 MHz license. Specifically, the service carriers must offer in the Lower 700 MHz band is an interoperable service that will work with Band Class 12 and Band Class 17 devices.
 - Similar to:
 - CALEA
 - CableCARDS
 - MDU Exclusivity Prohibitions
 - Title III regulations of carriers that affect equipment are on particularly solid ground because the statute expressly defines “radio communication” to include “all instrumentalities, facilities, [and] apparatus ... incidental to such [radio] transmission.” 47 U.S.C. § 153(40). Thus, the statute recognizes that the Commission’s authority to regulate radio communication encompasses oversight of network equipment and devices used to effectuate the communications.



FCC's Legal Authority to Act

The Commission has direct authority to regulate wireless devices to the extent necessary to restore interoperability in the 700 MHz band. Among other provisions, the Commission can rely on:

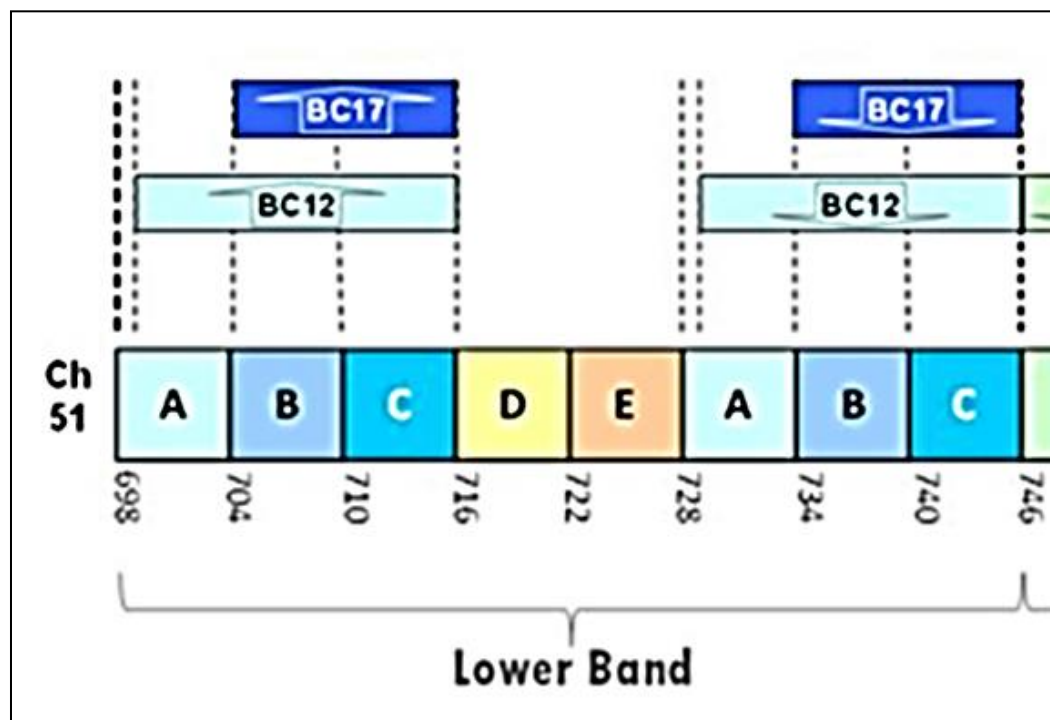
- Section 303(e) – authority to “regulate the kind of apparatus to be used with respect to its external effects and the purity and sharpness of the emissions from each station and from the apparatus therein.”
- Section 303(f) – authority to make regulations “to prevent interference between stations,” including “changes in frequencies [or] authorized power...” To the extent that the Commission’s order addresses interference with broadcast stations operating on Channel 51 or other forms of interference, Section 303(f) provides authority to do so.
- Section 302a(a) – additional authority to adopt regulations “governing the potential interference with devices which in their operation are capable of emitting radio frequency energy by radiation, conduction, or other means in sufficient degree to cause harmful interference to radio communications.” Again, given that AT&T’s actions claim to be based on its intention to avoid interference, the Commission’s response to those issues implicates its authority to prevent harmful interference.
- Section 316 – authority to modify licenses.



No Technical Constraints to Interoperability in the Lower 700 MHz Band



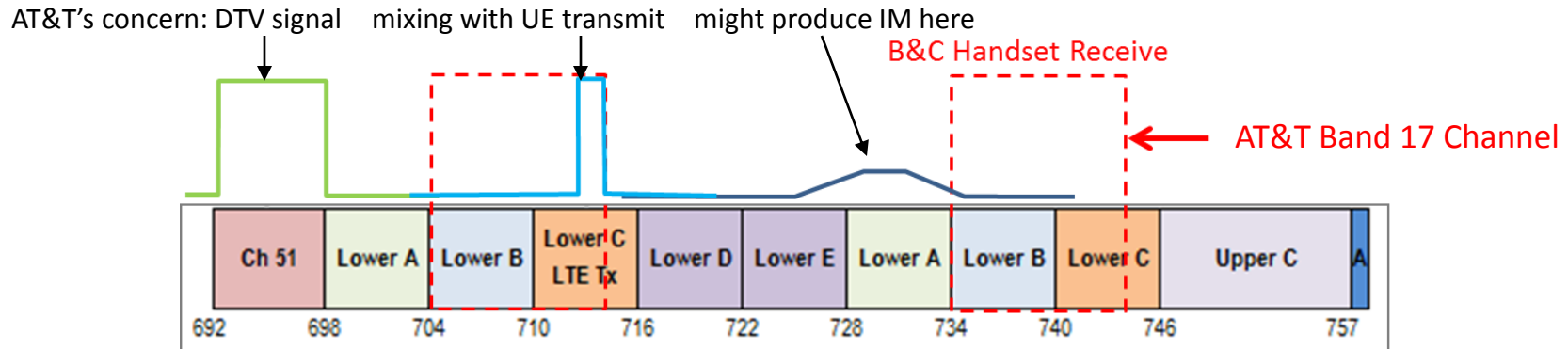
Two Lower 700 MHz Band Classes



- **Pre-Auction 73:** Only Band Class 12 was in progress in the 3GPP standards-setting process, covering Lower A, B and C Blocks for the UMTS technology¹
- **Post-Auction 73:** AT&T requested Band Class 17 creation in the 3GPP LTE standard, excluding the Lower A Block, citing fears of interference from Lower E and Channel 51²



Channel 51: Intermodulation Interference

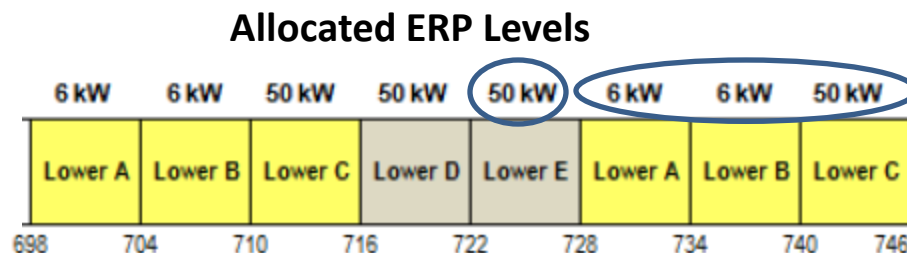


- **AT&T's Concern:** The high power broadcast signal in Channel 51 (green) might mix with Lower B or C device transmissions (light blue) to create intermodulation (dark blue) which might be strong enough to interfere with the device receiver
- **Lower 700 MHz tests have shown that DTV 51 will not cause interference to commercial LTE devices**
 - Commercial LTE and DTV stations were measured to document worst case market conditions³
 - Laboratory measurements documented commercial LTE device performance, showing no interference under market conditions⁴
 - AT&T's limited laboratory tests appeared affected by test instrument noise, negating the results⁵
- **Intermodulation tests in the H Block proceeding confirm the lack of interference in commercial LTE devices**
 - Sprint test results of PCS intermodulation showed no interference risk⁶
 - AT&T/T-Mobile test results reached similar conclusions: "LTE devices outperformed the 3GPP IMD specification by at least 38 dB."⁷

Channel 51 will not cause interference to Lower 700 MHz Band 12 devices.



Lower E Block: Device Receiver Blocking



- **AT&T's Concern:** The Lower E Block is allocated with a higher radiated power level than the neighboring LTE downlink blocks (728-746 MHz). If ground-level power from E is much higher than from A, B or C base stations, then LTE device receivers might experience blocking interference.
- **Lower 700 MHz tests have shown that the higher radiated E Block power will not cause device receiver blocking**
 - Commercial LTE and high-power E Block stations were measured in Atlanta to document ground-level signal strength⁸
 - Multiple laboratory tests documented commercial LTE device performance, showing no interference under market conditions⁹
 - Interoperability opponents have not presented device blocking measurements – ***there is no data supporting their claims***
- **Existing FCC rules adequately protect device operation in Lower A, B and C Blocks**
 - Prior to auction, the Commission included a rule to limit power flux density, controlling the signal levels at the ground¹⁰
 - In 2007, AT&T agreed that a 1 MHz guard band was sufficient to protect from a neighboring 50 kW power level¹¹
 - A recent DISH study demonstrated that the E Block 50 kW ERP does not result in higher ground-level signals than an LTE site¹²

High power E Block will not cause interference to Lower 700 MHz Band 12 devices.



An Interoperability Solution is Simple

- **AT&T's Concern:** If interference might exist, then interoperable devices might require RF hardware for both Band 12 and Band 17, and add hardware to AT&T's planned devices
- **Good news: There is no interference risk.** Since Band 12 devices will not experience interference from the Lower E Block or Channel 51, all Lower 700 MHz services should converge to a common band class covering the Lower A, B and C Blocks
- **Selecting a different component will make new devices interoperable:** AT&T's planned devices would simply incorporate wider filters in the place of Band 17 filters, and would load the interoperable software in the future devices. This approach does not alter the device design
- **Various technical solutions are possible** to support a seamless transition to interoperability, with inconsequential costs



3G Fallback is Not a Concern

- **AT&T's Concern:** Consumers would not benefit from interoperable LTE service because the 3G systems deployed by the operators are different; AT&T employs UMTS and some competitive carriers employ CDMA. Consumers traveling outside of the LTE service area may need CDMA support
 - **First,** many Lower 700 MHz licensees are new entrants with no legacy 3G systems
 - **Second,** many Lower 700 MHz licensees operate GSM or UMTS-based 3G systems, fully compatible with AT&T's
 - **Third,** Lower 700 MHz licensees with CDMA-based 3G systems have multiple solutions for leveraging interoperability, such as delivering LTE service throughout their operating footprint

All consumers (and AT&T and competitive carriers) would benefit from fully interoperable LTE service



Interoperability Requires No Additional Equipment or Infrastructure Spending

Considerations	Changes	Additional Costs
700 MHz Handsets antennas, duplex filters, power amplifiers, low noise amplifiers, base band hardware, base band software	No change OEM simply installs interoperable filter and software at the factory in lieu of present filter and software	No additional cost OEM simply uses interoperable filter instead of non-interoperable filter at the factory – a replacement with <u>zero</u> difference in cost at scale
700 MHz Base Stations antennas, duplex filters, power amplifiers, low noise amplifiers, base band hardware, base band software, network controls	No change, except a one-time software upgrade to allow the base station to interoperate with devices supporting all A, B and C Block channel numbering	No material cost Carrier implements the requisite software change during the routine software-update cycle. (While software development could, generously, cost perhaps \$2 M, this figure represents a small fraction of LTE software expenses and an even smaller fraction of overall LTE system costs.)
Channel 51 and 700 MHz E Block Incumbents including all deployed Channel 51 operations and any 700 MHz E Block deployments	No change Extensive field and laboratory testing shows no changes required	No additional cost Band 12 and Band 17 systems have <u>identical</u> performance specifications to manage Channel 51 operations. Band Class 12 already effectively manages high power E Block deployments



Moving Channel 51 Broadcasters Will Not Resolve Interoperability Concerns

- Channel 51 full power broadcasters must be protected by adjacent A Block licensees, which present network deployment challenges in roughly 30 markets.
- Requiring Channel 51 broadcasters to move would assist some A Block licensees with base station deployment obstacles, but would not solve the problems of economies of scale, roaming, competition, spectrum efficiency, and consumer harm that the current lack of interoperability creates.
- AT&T may keep Band Class 17 even if all Channel 51 broadcasters were moved, especially given AT&T's incentive to maintain and expand the non-interoperable Band Class 17 for carrier aggregation and special features.



Industry-based Solutions Will Not Emerge

- FCC action is essential
 - Interoperability opponents have expressed mid- to long-term commitment to the bifurcated ecosystem.
 - Vendors will not oppose the direction indicated by their largest customer in the Lower 700 MHz Band.
- The Commission has clear legal authority to adopt an interoperability solution under these circumstances, which constitute a ‘worst-case’ scenario for which regulatory action is necessary



Interoperability Produces Numerous Benefits

Consumer Benefits: Availability, Affordability, and Customer Satisfaction

Increases availability and affordability of end user equipment and mobile service options

Reduces switching costs for consumers seeking to change providers

Enhances customer satisfaction and retention through lower costs, more options, and shorter wait periods

Increases competition in pricing and services

Competitive Carrier Benefits: Device Scale, Roaming, and Competition

Increases economies of scale for small and regional carriers by participation in a larger ecosystem

Enhances nationwide roaming opportunities for small and regional carriers

Promotes greater competition for next-generation wireless services, especially in rural areas

Spectrum Efficiency and 4G Deployment Benefits

Encourages more efficient use of licensed spectrum that is currently not substantially deployed

Helps alleviate the current spectrum crunch

Accelerates 4G deployment throughout the country

Provides an incentive for broader participation in future spectrum auctions

Public Interest Benefits: Innovation, Investment, and Job Growth

Creates a larger and more diverse device ecosystem that will spur innovation in the Lower 700 MHz band

Unleashes billions of dollars of investment in 4G LTE networks, creating over 100,000 jobs during the next 5 years



References

1. 3GPP TR 25.822 v1.0.0 (2007-11), “UMTS 700 MHz Work Item Technical Report” (Release 8).
2. 3GPP TSG RAN WG4 Mtg #48 Jeju, Korea, R4-082179 Change Request to 36.101, “Addition of Band 17”, AT&T, August 18-22, 2008; and 3GPP TSG RAN WG4 Mtg #48bis Edinburgh, UK, R4-082559 “UE Receiver Performance Specifications for Band 17”, AT&T, September 29-October 3, 2008.
3. “Lower 700 MHz Test Report: Laboratory and Field Testing of LTE Performance near Lower E Block and Channel 51 Broadcast Stations” (Apr. 11, 2012) (attached to Notice of Ex Parte Presentations by Cavalier Wireless, C Spire Wireless, Continuum 700 LLC, King Street Wireless, L.P., Metro PCS Communications, Inc., U.S. Cellular, and Vulcan Wireless; WT Docket No. 12-69 (May 29, 2012), (Hyslop-Kolodzy Report), sections 4.3, 4.4 and 5.3. *See also* WT Docket No. 12-69, V-Comm, LLC reply comments, July 13, 2012 (V-Comm Report), section V D.
4. Hyslop-Kolodzy Report, section 5.4. V-Comm Report, section V C.
5. Ex parte presentation by C Spire Wireless, August 1, 2012, WT Docket No. 12-69, at 4 of attachment.
6. Reply comments of Sprint Nextel Corporation, March 7, 2013, WT Docket No. 12-357, at 10 and Exhibit A at 68-74.
7. Ex parte presentation by AT&T Services, Inc., May 14, 2013, WT Docket No. 12-357, “H Block Compatibility Analysis for GSM, UMTS and LTE”, at 18. A joint laboratory test report by AT&T and T-Mobile.
8. Hyslop-Kolodzy Report, sections 4.3-4.7.
9. Hyslop-Kolodzy Report, section 4.2. V-Comm Report, section VI, B-C.
10. Reallocation and Service Rules for the 698-746 MHz Spectrum Band (Television Channels 52-59), Report and Order, 17 FCC Rcd. 1022, 1063-64 (2002).
11. Reply Comments of AT&T, June 4, 2007, WT Docket No. 06-150, p. 27.
12. Ex parte presentation by DISH Network Corporation, May 29, 2013, WT Docket No. 12-69, technical report at 10.

